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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/023,125	12/17/2001	Jong Hyun Yoo	AMAT/5730	4585

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EXAMINER	
SMITH, FRANCIS P	

ART UNIT	PAPER NUMBER
4151	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/023,125	YOO ET AL.	
	Examiner	Art Unit	
	FRANCIS P. SMITH	4151	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 December 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-30* is/are pending in the application.

4a) Of the above claim(s) *25-30* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) *1-30* are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *17 December 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *See Continuation Sheet*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Continuation of Attachment(s) 3). Information Disclosure Statement(s) (PTO/SB/08), Paper No(s)/Mail Date :4/3/2002,5/6/2002,7/1/2002,2/7/2003,5/15/2003, 4/15/2004,9/20/2004,6/2/2005, 3/27/2006.

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-24, drawn to a process for depositing metal film, classified in class 427, subclass 248.1.

II. Claims 25-30, drawn to a system for depositing a metal film, classified in class 118, subclass 715.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another and materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus as claimed can be used to practice another and materially different process, such as the etching of a substrate.

3. Restriction for examination purposes as indicated is proper because all these inventions listed in this action are independent or distinct for the reasons given above and there would be a serious search and examination burden if restriction were not required because one or more of the following reasons apply:

(a) the inventions have acquired a separate status in the art in view of their different classification;

(b) the inventions have acquired a separate status in the art due to their recognized divergent subject matter;

(c) the inventions require a different field of search (for example, searching different classes/subclasses or electronic resources, or employing different search queries);

(d) the prior art applicable to one invention would not likely be applicable to another invention;

(e) the inventions are likely to raise different non-prior art issues under 35 U.S.C. 101 and/or 35 U.S.C. 112, first paragraph.

Applicant is advised that the reply to this requirement to be complete must include (i) an election of a invention to be examined even though the requirement may be traversed (37 CFR 1.143) **and (ii) identification of the claims encompassing the elected invention**.

The election of an invention may be made with or without traverse. To reserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the restriction requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable on the elected invention.

If claims are added after the election, applicant must indicate which of these claims are readable upon the elected invention.

Should applicant traverse on the ground that the inventions are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the inventions to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

During a telephone conversation with Keith M. Tackett, Esq. on December 12, 2007 a provisional election was made with traverse to prosecute the invention of group I, claims 1-24. Affirmation of this election must be made by applicant in replying to this Office action. Claims 25-30 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1 and 10 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

3. The term "rapidly" in claim 1 is a relative term which renders the claim indefinite. The term "rapidly" is not defined by the claim, the specification does not provide a

standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

4. Claim 10 recites the limitation "said first pressurization… and said second pressurization" in lines 2 and 3 of claim 10. There is insufficient antecedent basis for this limitation in the claim.

Drawings

The drawings are objected to because Figure 3 lacks the labels for the feed lines 33b and 33c. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either “Replacement Sheet” or “New Sheet” pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

4. The disclosure is objected to because of the following informalities: In paragraph [0040] line 1, "Where it determined, at step 320…" is believed to read "Where it determined at step 322… " for examination purposes.

Appropriate clarification and/or correction is required.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1,4,6,9 and 14 are rejected under 35 U.S.C. 102(b) as being anticipated by Meng Chu Tseng et al. (EP 0704551).

Tseng teaches a method of processing a substrate in a vacuum processing chamber. The method of Tseng comprises heating the substrate in a processing chamber. Then, a process gas consisting of WF_6 (a tungsten source) and dicholorosilane (a hydrogen source) was introduced and subsequently removed from the said processing chamber via a purge step (col. 9, lines 49-54).

Regarding claims 4 and 6, an argon purge gas is introduced into a chamber, which is lower (decreasing a pressurization) than the initial pressure (col. 9, lines 49-54).

As per claim 9, a bulk deposition layer of metal was formed after a process gas was introduced and removed from a processing chamber (col. 9, lines 49-54).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g)

prior art under 35 U.S.C. 103(a).

10. Claims 3,12,and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tseng et al. (EP 0704551).

Regarding claim 3, Tseng discloses the use of and exhaust system equip with a throttle valve that can regulate the pressure of the chamber (col. 6, lines 15-17). Furthermore, Tseng discloses a first pressure level of 2 torr during the conditioning/soak step. Then, the processing gases were introduced and the bottom of the chamber was purged with argon while the chamber was at 0.8 torr (col. 9, lines 43-54). Although Tseng does not explicitly state the pressure upon introduction of the process gas, it would be obvious to one skilled in the art to use Tseng's throttle valve to control and maintain an initial pressure greater than a first pressure level at the introduction of the purge gas that is greater than the second pressure level upon removing said process gas in order to successfully deposit a uniform tungsten layer of desired density with few contaminants on the substrate.

Regarding claims 12 and 13, Tseng teaches a conditioning step which is set to an initial pressure of 2 torr, which is a greater than the pressure of the chamber (.8 torr) for the introducing/removing of the process gas. Furthermore, during this conditioning/initial step, silane (a hydrogen source) is introduced into the chamber (col. 9, lines 43-54).

11. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tseng et al. (EP 0704551) in view of Lee (US 5,455,069).

For claim 11, Tseng teaches using tungsten hexafluoride and dichlorosilane, but does not teach using one of silane, molecular hydrogen, or diborane. Lee, however, teaches a method of improving layer uniformity where dichlorosilane may be used interchangeably with silane (col. 3, lines 12-20). Because these two gases were art-recognized equivalents at the time the invention was made, one of ordinary skill in the art at the time of the invention would have found it obvious to substitute Lee's silane for the dichlorosilane of Tseng's method in order to coat the substrate with a tungsten containing layer. *In re Ruff, 256 F.2d 590, 118 USPQ 340 (CCPA 1958).*

12. Claims 2,8,7,10,15, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tseng et al. (EP 0704551) in view of Emesh (US 5, 407,698).

As for claims 2,8 and 15, Tseng discloses a method of processing a substrate in a processing chamber but does not teach repeating a nucleation cycle multiple times while varying the metal/hydrogen ratio. Emesh, however, discloses a method for low pressure chemical deposition of tungsten that entails depositing a first layer of tungsten with a H_2/WF_6 ratio of 6, followed by depositing a second layer of tungsten with a H_2/WF_6 ratio of 20 (col. 3, lines 55-68; col. 4, lines 1-4). Therefore, it would have been obvious to one skilled in the art at the time of the invention to include the nucleation cycles of Emesh in Tseng's method in order to obtain a base film capable of adequately supporting a bulk deposition of tungsten.

For claims 7 and 10, Tseng teaches a method of processing a substrate in a processing chamber but is silent with regard to the time interval for nucleation, or introducing/terminating the processing gas. Furthermore, Tseng teaches a first and

second pressurization, but fails to specify an approximate pressure of 15 and 1-3 torr, respectively. It is noted that these processing parameters, such as the nucleation time and pressure, are result effective. The pressure range used will depend on the desired film density and level of gaseous contamination tolerable in a given system, and the nucleation time affects the thickness of the resulting film. However, discovery of the optimum values of result effective variables in known processes would have been obvious to a person of ordinary skill in the art at the time of the invention. Consult In re Boesch and Slaney (205 USPQ 215 (CCPA 1980)).

As for claim 16, Tseng discloses a bulk deposition layer of metal was formed after a process gas was introduced and removed from a processing chamber (col. 9, lines 49-54).

13. Claims 17-21, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tseng et al. (EP 0704551) in view of Emesh (US 5, 407,698) and further in view of Lee (US 5,455,069).

For claim 17, Tseng does not specifically teach using tungsten hexafluoride and one of silane, molecular hydrogen, or diborane, but instead uses dichlorosilane. Lee, however, teaches a method of improving layer uniformity where dichlorosilane may be used interchangeably with silane (col. 3, lines 12-20). Because these two gases were art-recognized equivalents at the time the invention was made, one of ordinary skill in the art at the time of the invention would have found it obvious to substitute Lee's silane for the dichlorosilane of Tseng's method in order to coat the substrate with a tungsten

containing layer. *In re Ruff, 256 F.2d 590, 118 USPQ 340 (CCPA 1958).*

Regarding claims 18 and 19, Tseng teaches a conditioning step which is set to an initial pressure of 2 torr, which is a greater than the pressure of the chamber (.8 torr) for the introducing/removing of the process gas. Furthermore, during this conditioning/initial step, silane (a hydrogen source) is introduced into the chamber (col. 9, lines 43-54).

Regarding claim 20, Tseng discloses the use of and exhaust system equip with a throttle valve that can regulate the pressure of the chamber (col. 6, lines 15-17). Furthermore, Tseng discloses a first pressure level of 2 torr during the conditioning/soak step. Then, the processing gases were introduced and the bottom of the chamber was purged with argon while the chamber was at 0.8 torr (col. 9, lines 43-54). Although Tseng does not explicitly state the pressure upon introduction of the process gas, it would be obvious to one skilled in the art to use Tseng's throttle valve to control and maintain an initial pressure greater than a first pressure level at the introduction of the purge gas that is greater than the second pressure level upon removing said process gas in order to successfully deposit a uniform tungsten layer of desired density with few contaminants on the substrate.

For claim 21, Tseng utilizes an argon purge gas, which is introduced into a chamber at a lower pressure(decreasing a pressurization) than the initial pressure (col. 9, lines 49-54).

As per claim 23, Tseng discloses an argon purge gas is introduced into a chamber, which is lower (decreasing a pressurization) than the initial pressure (col. 9,

lines 49-54).

Regarding claim 24, Tseng discloses a method of processing a substrate in a processing chamber but does not teach repeating a nucleation cycle multiple times while varying the metal/hydrogen ratio. Emesh, however, discloses a method for low pressure chemical deposition of tungsten that entails depositing a first layer of tungsten with a H_2/WF_6 ratio of 6, followed by depositing a second layer of tungsten with a H_2/WF_6 ratio of 20 (col. 3, lines 55-68; col. 4, lines 1-4). Therefore, it would have been obvious to one skilled in the art at the time of the invention to include the nucleation cycles of Emesh in Tseng's method in order to obtain a base film capable of adequately supporting a bulk deposition of tungsten.

14. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tseng et al. (EP 0704551) in view of Emesh (US 5, 407,698), Lee (US 5,455,069), and further in view of Rajagopalan et al. (US6,156,382).

For claim 22, Tseng does not teach maintaining a pressurization at a constant level . Rajagopalan teaches a chemical vapor deposition process for depositing tungsten whereby a system controller controls all of the activities of the CVD machine. The system controller executes system control software equip with a pressure control subroutine for controlling the pressure in the chamber (col. 6, lines 44-47). Therefore, it would have been obvious to one skilled in the art at the time of the invention to adapt Tseng by using Rajagopalan's software to maintain a pressurization of the said processing chamber at a constant level in order to purge the processing chamber in a

stable environment using a purge gas.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to FRANCIS P. SMITH whose telephone number is (571)270-3717. The examiner can normally be reached on Monday through Friday 7:30 AM-5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mikhail Kornakov can be reached on (571)272-1303. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

FPS

/Michael Kornakov/
Supervisory Patent Examiner, Art Unit 4151